

WHAT IS CLAIMED IS:

1. An aqueous sizing composition comprising:
  - (a) a first component including an emulsion having an alkenylsuccinic anhydride component containing (i) alkenylsuccinic anhydride particles and (ii) surfactant component; suspended in water; and
  - (b) a second component selected from the group consisting of cationic starches, non-ionic starches, anionic starches, water, water-soluble polymers, and mixtures thereof;wherein the alkenylsuccinic anhydride component and the second component are sufficiently diluted to enable the sizing composition to impart useful sizing properties to a fibrous substrate when the sizing composition contacts the fibrous substrate.
2. The sizing composition of Claim 1, wherein the surfactant component is selected from the group consisting of sulfosuccinates, alkyl and aryl amides and primary, secondary and tertiary amines and their corresponding quaternary salts fatty acids, ethoxylated fatty acids, fatty alcohols, ethoxylated fatty alcohols, fatty esters, ethoxylated fatty esters, ethoxylated triglycerides, certain ethoxylated lanolin, sulfonated amines, sulfonated amides, ethoxylated polymers, propoxylated polymers, ethoxylated/ propoxylated copolymers, polyethylene glycols, phosphate esters, phosphonated fatty acid ethoxylates, phosphonated fatty alcohol ethoxylates, alkyl sulfonates, aryl sulfonates, alkyl sulfates, aryl sulfates, and combinations thereof.
3. The sizing composition of Claim 1, wherein the surfactant component is present at a level ranging from about 0.1 weight % up to about 20 weight %, based on alkenylsuccinic anhydride.
4. The sizing composition of Claim 1, wherein the alkenyl succinic anhydride particles have a median particle size ranging from about 0.5 to about 20 microns.
5. The sizing composition of Claim 1, wherein the alkenylsuccinic anhydride component further comprises hydrolyzed

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alkenylsuccinic anhydride in an amount ranging from about 1 to about 99% based on the total weight of the alkenylsuccinic anhydride.

6. The sizing composition of Claim 1, wherein the sizing composition is of sufficient dilution so that when the sizing composition treats a fibrous substrate, the treated fibrous substrate has a Cobb sizing of less than about 150 gsm for 30 minutes or about 100 gsm for two minutes.

7. The sizing composition of Claim 1, wherein the sizing composition is of sufficient dilution so that if the sizing composition treats a fibrous substrate, the treated fibrous substrate retards ink penetration, giving an HST value of at least ten seconds.

8. The sizing composition of Claim 1, wherein the sizing composition is of sufficient dilution to minimize the sizing composition from coalescing at a temperature ranging from about 40 to about 200 °F.

9. The sizing composition of Claim 1, wherein the alkenyl succinic anhydride particles have a monomodal particle distribution.

10. The sizing composition of Claim 1, wherein the alkenyl succinic anhydride particles have a bimodal or a multimodal particle distribution.

11. The sizing composition of Claim 1, wherein the alkenyl succinic anhydride is present from about 0.001 to about 5 wt percent %.

12. The sizing composition of Claim 1, wherein the polymer component is a water-soluble polymer selected from the group consisting of cationic vinyl addition polymers, anionic vinyl addition polymers, neutral polymers, ampholytic polymers, condensation polymers, and combinations thereof.

13. A fibrous substrate treated with the sizing composition of Claim 1.

14. The fibrous substrate of Claim 13, wherein the substrate is paperboard.

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15. The fibrous substrate of Claim 13, wherein the paperboard exhibits a Cobb sizing value, based on one minute, ranging from about 50 to about 120 grams per square meter.

16. The fibrous substrate of Claim 13, wherein the  
5 substrate is fine paper.

17. The fibrous substrate of Claim 16, wherein the fine paper exhibits a Cobb sizing value, based on 1 minute, ranging from about 18 to about 40 gsm.

18. The fibrous substrate of Claim 13, wherein the substrate is  
10 selected from the group consisting of newsprint, other wood-containing papergrades, and combinations thereof.

19. The fibrous substrate of Claim 18, wherein the substrate is newsprint substrate that exhibits a sizing property ranging from about 10 to about 100 seconds, as measured by a water drop test, based on 5  $\mu$ L  
15 water drop size.

20. A process for making a sizing composition comprising the steps of:

(a) emulsifying an alkenylsuccinic anhydride component containing  
(i) alkenylsuccinic anhydride and (ii) a surfactant component, with water;  
20 and thereby forming an emulsion; and

(b) combining the emulsion with a second component selected from  
the group consisting of cationic starches, non-ionic starches, anionic  
starches, water, water-soluble polymers, and mixtures thereof, thereby  
forming a sizing composition comprising:

25 (1) a first component comprising an emulsion having an alkenylsuccinic anhydride component containing alkenylsuccinic anhydride particles and a surfactant component, suspended in water, and

(2) a second component selected from the group consisting of  
cationic starches, non-ionic starches, anionic starches, water, water-  
30 soluble polymers, and mixtures thereof,

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wherein the alkenylsuccinic anhydride component and the second component are sufficiently diluted to enable the sizing composition to impart useful sizing properties to a fibrous substrate when the sizing composition contacts the fibrous substrate.

- 5           21. The process of Claim 20, wherein the surfactant component is selected from the group consisting of sulfosuccinates, alkyl and aryl amides and primary, secondary and tertiary amines and their corresponding quaternary salts fatty acids, ethoxylated fatty acids, fatty alcohols, ethoxylated fatty alcohols, fatty esters, ethoxylated fatty esters, 10 ethoxylated triglycerides, certain ethoxylated lanolin, sulfonated amines, sulfonated amides, ethoxylated polymers, propoxylated polymers, ethoxylated/ propoxylated copolymers, polyethylene glycols, phosphate esters, phosphonated fatty acid ethoxylates, phosphonated fatty alcohol ethoxylates, alkyl sulfonates, aryl sulfonates, alkyl sulfates, aryl sulfates, 15 and combinations thereof.

22. The process of Claim 20, wherein the surfactant component is present at a level ranging from about 0.1 weight % up to about 20 weight %, based on the alkenylsuccinic anhydride.

- 20           23. The process of Claim 20, wherein the pressure at which the emulsion is made ranges from about 1 psig to about 150 psig.

24. The process of Claim 20, wherein the temperature at which the emulsion is made ranges from more than about 40 °F to about 200 °F.

- 25           25. The process of Claim 20, wherein the emulsion is made with a shearing device having an inlet pressure that is at least about 1 psig to about 5 psig.

26. The process of Claim 20, wherein the emulsion is made with a shearing device having an inlet pressure ranging from about 5 psig to about 25 psig.

- 30           27. The process of Claim 20, wherein the emulsion is made with a shearing device having an outlet pressure ranging from about 15 psig to about 150 psig.

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28. The process of Claim 20, wherein the emulsion is made with a shearing device having an outlet pressure ranging from about 30 psig to about 100 psig.

29. The process of Claim 20, wherein the emulsion is made  
5 under shear conditions created by a device selected from the group consisting of centrifugal pumps, static in-line mixers, peristaltic pumps, magnetic stirring bar in a beaker, overhead stirrer, and combinations thereof.

30. The process of Claim 20, wherein the temperature at which  
10 the emulsion is made is less than about 40 °F, the temperature at which the second component ranges from more than about 40 °F to about 200 °F, and the emulsion is heated when it is combined with the second component.

31. A process for sizing a paper product comprising treating a  
15 fibrous substrate surface with an aqueous sizing composition including (1) a first component comprising an emulsion having an alkenylsuccinic anhydride component containing alkenylsuccinic anhydride particles and a surfactant component, suspended in water, and (2) a second component selected from the group consisting of cationic starches, non-ionic  
20 starches, anionic starches, water, water- soluble polymers, and mixtures thereof, and thereby forming a sized fibrous substrate.

32. The process of Claim 31, wherein the sized fibrous substrate is paperboard.

33. The process of Claim 31, wherein the paperboard exhibits a  
25 Cobb sizing value, based on one minute, ranging from about 50 to about 120 grams per square meter.

34. The process of Claim 31, wherein the sized fibrous substrate is fine paper.

35. The process of Claim 31, wherein the sizing composition is  
30 added to a water box.

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36. The process of Claim 31, wherein the sized fibrous substrate exhibits a Cobb sizing value, based on 1 minute, ranging from about 18 to about 40 gsm.

37. The process of Claim 36, wherein the sized fibrous substrate  
5 is selected from the group consisting of newsprint, other wood-containing papergrades, and combinations thereof.

38. The process of Claim 37, wherein the substrate is newsprint that exhibits a sizing property ranging from about 10 to about 100  
10 seconds, as measured by a water drop test, based on 5  $\mu$ L water drop size.

39. The process of Claim 31, wherein about 100% of the alkenylsuccinic anhydride in the sizing composition is retained in the fibrous substrate.

40. The process of Claim 31, wherein prior to treating the fibrous  
15 substrate surface, the process further comprises treating the fibrous sheet with a wet end sizing agent, wherein the wet end sizing agent component is present in an amount that is 50% or less of the total sizing agent used.

41. The process of Claim 31, wherein the sizing composition is made by

(a) emulsifying an alkenylsuccinic anhydride component containing (i) alkenylsuccinic anhydride and (ii) a surfactant component, with water; and thereby forming a first component containing an emulsion having an alkenylsuccinic anhydride component containing (i) alkenylsuccinic anhydride particles and (ii) a surfactant component; suspended in water; and

(b) combining the emulsion with a second component selected from the group consisting of cationic starches, non-ionic starches, anionic starches, water, water-soluble polymers, and mixtures thereof; thereby forming the sizing composition.

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42. The process of Claim 41, wherein the emulsion is made under shear conditions created by a device selected from the group consisting of centrifugal pumps, static in-line mixers, peristaltic pumps, magnetic stirring bar in a beaker, overhead stirrer, and combinations thereof.

43. The process of Claim 42, wherein the temperature at which the first component is made is less than about 40 F, the temperature at which the second component ranges from more than about 40 °F to about 200 °F, and the emulsion is heated when it is combined with the second component.

44. An aqueous sizing composition comprising:  
(a) a heated first component including an emulsion having an alkenylsuccinic anhydride component containing (i) alkenylsuccinic anhydride particles and (ii) surfactant component; suspended in water; and

(b) a second component selected from the group consisting of cationic starches, non-ionic starches, anionic starches, water, water-soluble polymers, and mixtures thereof;

wherein the alkenylsuccinic anhydride component and the second component are sufficiently diluted to enable the sizing composition to impart useful sizing properties to a fibrous substrate when the sizing composition contacts the fibrous substrate, and wherein the sizing composition is at a temperature that is more than about 40 F.

45. An aqueous sizing composition comprising:  
(a) a first component including an emulsion having an alkene ketene dimer component containing (i) alkene ketene dimer particles and (ii) surfactant component; suspended in water; and

(b) a second component selected from the group consisting of cationic starches, non-ionic starches, anionic starches, water, water-soluble polymers, and mixtures thereof;

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wherein the alkylene ketene dimer component and the second component are sufficiently diluted to enable the sizing composition to impart useful sizing properties to a fibrous substrate when the sizing composition contacts the fibrous substrate.